Pergamon

Mechanics Research Communications, Vol. 24, No. 2, pp. 131–136, 1997

0093-6413/97 $17.00 + .00

PII S0093-6413(97)00004-9

THE EXACT SOLUTION OF THE PLANE ELASTICITY PROBLEMS FOR THE NON-SYMMETRIC AIRFOIL CRACK

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(Received 18 July 1996; accepted for print 24 January 1997)

Introduction

The first and second basic problems are solved simultaneously by the method used in [1] for the symmetric airfoil crack. The form of the crack depends of some parameters and its exterior is the image of the unit disk exterior under the mapping by the function (8). The solution is applied to the problem of two-dimensional Stokes flow of viscous fluid about the airfoil.

Analysis

The elasticity first and second basic problems [2] for an unbounded domain D can be reduced to finding two analytic functions

$$f(z) = \Gamma z - \frac{X + iY}{2\pi(1+\kappa)} \ln z + f_0(z), \tag{1}$$

$$g(z) = \Gamma' z + \frac{\kappa(X - iY)}{2\pi(1+\kappa)} \ln z + g_0(z), \tag{2}$$

Γ and Γ' being known ($Im\Gamma = 0$ for the first basic problem), $f_0(z)$ and $g_0(z)$ being analytic in D, $X + iY$ is known for the second basic problem and is defined via the boundary condition for the first basic problem. The boundary condition is

$$\{kf(z) + z\overline{f'(z)} + \overline{g(z)}\}_{|z=z(t)} = R(t), \tag{3}$$

here $z = z(t)$, $t \in [0, T]$, is the equation of the boudary curve ∂D; $k = 1$, $R(t) = f_1(t) + if_2(t) + const$ is the external stress vector acting on the arc correspondent to $[0, t]$ for